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IS 10236-10 (1985): Procedure for basic climatic and durability test for optical instruments, Part 10: Bump test [PGD 22: Educational Instruments and Equipment]

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Indian Standard

PROCEDURE FOR BASIC CLIMATIC AND DURABILITY TESTS FOR OPTICAL INSTRUMENTS

PART 10 BUMP TEST

UDC 681·7 : 620·178·786

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Indian Standard
PROCEDURE FOR BASIC CLIMATIC AND DURABILITY TESTS FOR OPTICAL INSTRUMENTS
PART 10 BUMP TEST

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Indian Standard
PROCEDURE FOR BASIC CLIMATIC AND DURABILITY TESTS FOR OPTICAL INSTRUMENTS
PART 10 BUMP TEST

0. FOREWORD

0.1 This Indian Standard (Part 10) was adopted by the Indian Standards Institution on 20 May 1985, after the draft finalized by the Optical and Mathematical Instruments Sectional Committee had been approved by the Mechanical Engineering Division Council.

0.2 Fast development in the field of instruments had brought a significant change in their basic content and design. It has been felt over the years that IS : 2352-1963* does not cater to the present day needs of the instruments and is also not in line with the recent trends in climatic and environmental testing procedures to be adopted for improving their quality and reliability. It has, therefore, become necessary to have uniform and more rational testing procedures as far as possible. This series of standards on climatic and durability test (IS : 10236) has been prepared with this objective.

0.2.1 It is proposed to withdraw the existing Indian Standard (IS : 2352 - 1963*) as soon as the tests mentioned therein are covered in the new series (IS : 10236).

1. SCOPE

1.1 This standard (Part 10) covers the procedure for conducting bump test for optical instruments.

2. TERMINOLOGY

2.0 For the purpose of this standard the following definitions in addition to those given in IS : 10236 (Part 1) 'Procedure for basic climatic and durability tests for optical instruments : Part 1 General (*under preparation*)' shall apply.

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*Procedure for basic climatic and durability tests for optical instruments.

2.1 Bumps — Bumps are repetitive shocks likely to be encountered by equipments during use or transportation.

3. OBJECT

3.1 The object of this test is to determine the capability of optical instruments to withstand prolonged bumping, such as encountered in rail or road transport, track driven vehicles or aircraft landings.

4. INITIAL MEASUREMENTS

4.1 The instrument shall be visually examined and checked optically, electrically and mechanically as required by the relevant instrument specification.

5. BUMP MACHINE

5.1 A bump test machine used for this test shall have characteristics specified in **5.1.1** to **5.1.7**.

Note — In certain cases, for instance with the highly reactive loads, the relevant specification may allow tolerances less severe than those specified below.

5.1.1 The machine shall have a free falling table or platform on which instrument shall be mounted using its fixtures. While in use and during measurement the platform shall be correctly loaded to its nominal value.

5.1.2 *Monitoring* — The impact shall be monitored by an accelerometer rigidly attached to the table or fixture, if used, at a point nearest to one of the specimen fixing points. For this purpose that specimen fixing point shall be chosen which is also nearest to the centre of the table surface unless there is a specimen fixing point having a more rigid connection to the table or fixture, in which case this shall be chosen.

5.1.3 *Basic Pulse Shape* — It shall be capable of generating at the monitoring point a bump pulse approximating to one half cycle of a sine wave having peak acceleration of 40 ± 4 g and duration 6 ± 1 milliseconds.

5.1.4 *Accuracy* — The accuracy of the measuring system shall be such that it can be determined that the true value is within the given tolerances.

5.1.5 *Repetition Rate* — The bump repetition rate shall be adjustable from 1 to 3 bumps per second (and between impacts, the relative motion within the specimen shall be substantially zero). It shall also be possible to adjust the motion of the table, so that the secondary impacts due to rebound are reduced to a minimum.

5.1.6 *Distortion* — The amplitude of any waveform distortion, such as superimposed high frequencies, shall not exceed 20 percent of the amplitude of the fundamental waveform.

5.1.7 The machine shall have provision of a device for counting of bumps.

6. TEST SEVERITY

6.1 The degree of test severity comprising total number of bumps may be selected from the following:

a)	Total bumps	1 000 ± 10
b)	Total bumps	4 000 ± 10

7. TEST PROCEDURE

7.1 The test is primarily intended for unpacked specimens. However the items may be tested in their transport cases when such cases are considered as part of the specimen itself. The mode of the testing shall be specified in the relevant instrument specification.

7.2 Whether the specimen has to operate during bump or merely to survive conditions of bump shall be clearly stated in the relevant instrument's specification. In either case, the relevant specification should always prescribe the acceptable tolerance on performance which allows the specimen to be considered satisfactory.

7.3 Mounting — Instrument in its unpacked condition or in its transport case (if so required) shall be fastened to the bump machine either directly or by means of a fixture. Mounting fixture shall be such as to enable the specimen to be subjected to bumps along the various axes as specified for conditioning. External connections necessary for measuring purposes shall add minimum restraint and mass.

7.3.1 Instrument intended for operation in an environment where bumping takes place (for example, in moving vehicles) shall be fastened to the machine by its normal means of attachment, unless otherwise specified.

7.3.2 Instrument intended for use with isolators shall normally be tested with its isolators. If it is impracticable to carry out the test using the correct isolator for example, when the instrument is mounted with other equipment in a common mounting system, the relevant instrument specification may permit bump test on the instrument using isolators specified for this case.

7.3.3 Any additional stays or straps should be avoided. If cables or other items are required to be connected to the instrument during the test, these should be arranged so as to add similar restraint and mass as in the normal installation.

7.3.4 When the bump test is employed as an arbitrary test to demonstrate certain degree of robustness in an instrument which is normally protected by isolators, the equipment shall, unless otherwise specified, be mounted directly to the table and test carried out with the isolators removed or blocked.

7.3.5 The relevant instrument specification shall state whether the effect of gravitational force is important. In this case instrument shall be so mounted that the gravitational force acts in the same direction as it would in normal use. Where the effect of gravitational force is not important, the instrument may be mounted in any attitude.

7.4 Conditioning

7.4.1 Where the attitude of the specimen, when mounted or transported, is known and since bumps are generally of greatest significance in one direction (usually vertical), the specified number of bumps shall be applied in that direction and attitude only. However, where the attitude is not known, the total number of bumps and directions shall be given as specified in the relevant instrument specification.

7.4.2 The specimen shall then be subjected to the specified number of bumps of the required severity at a peak acceleration of 40 ± 4 g and duration 6 ± 1 milliseconds.

7.4.3 If required, the relevant instrument specification shall state whether the instrument shall be operating and if functional checks are required at any stage.

7.4.4 The instrument shall then be removed from the table.

8. FINAL MEASUREMENTS

8.1 The instrument shall be visually examined for any signs of mechanical damage or looseness of parts. Its performance shall also be checked in accordance with the relevant instrument specification. The sealed instrument shall also be checked for leaks.

9. DETAILS TO BE GIVEN IN RELEVANT INSTRUMENT SPECIFICATION

9.1 The relevant instrument specification shall state the following for carrying out this test:

a) Initial observations/measurements;

b) Test severity;

c) Mode of testing — unpacked or in its transport case;

d) Whether the instrument has to operate during bumps or merely to survive this condition (acceptable tolerance or performance to be prescribed);

e) Details of mounting and isolators, if so required;

f) The attitude or directions during conditioning;

g) Operational and functional checks, if any;

h) Final observations/measurements; and

j) Any deviation from the normal procedure.

INTERNATIONAL SYSTEM OF UNITS (SI UNITS)

Base Units

QUANTITY	UNIT	SYMBOL
Length	metre	m
Mass	kilogram	kg
Time	second	s
Electric current	ampere	A
Thermodynamic temperature	kelvin	K
Luminous intensity	candela	cd
Amount of substance	mole	mol

Supplementary Units

QUANTITY	UNIT	SYMBOL
Plane angle	radian	rad
Solid angle	steradian	sr

Derived Units

QUANTITY	UNIT	SYMBOL	DEFINITION
Force	newton	N	1 N = 1 kg.m/s^2
Energy	joule	J	1 J = 1 N.m
Power	watt	W	1 W = 1 J/s
Flux	weber	Wb	1 Wb = 1 V.s
Flux density	tesla	T	1 T = 1 Wb/m^2
Frequency	hertz	Hz	1 Hz = 1 c/s (s^{-1})
Electric conductance	siemens	S	1 S = 1 A/V
Electromotive force	volt	V	1 V = 1 W/A
Pressure, stress	pascal	Pa	1 Pa = 1 N/m^2